EIGHTH GRADE ADOLESCENT SUBSTANCE USE AND INVOLVEMENT WITH DRUG-USING FRIENDS: PROSOCIAL ENVIRONMENT AS A MODERATING FACTOR

by

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ABSTRACT

The current study investigated the relationship between individual adolescent drug use, friends' drug use, and school, family, and community prosocial environments. Survey data from the 2007 SHARP survey collected from schools in a western state were analyzed to better understand the relationship between the aforementioned variables. A total of 10,767 eighth grade student surveys were used in the analysis. Single-level logistic regression analyses were then conducted with the dataset and results indicated a significant positive relationship between peer substance use and adolescents' own individual substance use, which is consistent with prior substance abuse research. Analyses also indicated that school, family, and community prosocial environment did act as protective factors by reducing the likelihood of adolescent drug use; however, these factors did not significantly moderate the relationship between friends' drug use and eighth grade adolescent drug use, although community and family prosocial environment interaction variables did approach statistical significance.

Results from the present study indicate that drug use by adolescents' friends is a significant risk factor that appears to contribute to eighth grade adolescent substance use at a level that may not be easily reduced. Future research on prosocial environments that includes a more diverse sample, a variety of age groups, and multiple measures may provide a better understanding of these protective factors.

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CHAPTER I

INTRODUCTION

Substance use[1] is one of the largest causes of morbidity and death among youth within the United States (Johnston, O'Malley, Bachman, & Schulenberg, 2009b). In addition to serious problems that often occur during adolescence, substance use can also lead to difficulties that persist, and possibly deteriorate, well into adulthood. The total estimated economic cost of youth and adult substance use was estimated at $180.8 billion in 2002 (Office of National Drug Control Policy, 2004). These costs included areas such as incarceration, drug abuse-related illness, crime victimization, treatment, premature death, social welfare and lost productivity. Understanding the factors that contribute to adolescent substance use informs prevention and treatment development and improvement efforts, provides insight into other comorbid behavioral difficulties that

[1] For the purpose of this thesis, the terms "substance use" and "drug use" are used interchangeably and denote any use of controlled substances and other substances, such as alcohol, that are illegal for adolescents to consume. Some might argue that the term "abuse" is a more accurate or appropriate term that distinguishes between experimental use of substances and higher levels of use; however, the nature of the variables that will be examined in this study will likely be better understood by considering lower levels of use (i.e., early initiation of drug use) by younger adolescents, especially given that the target group (eighth graders) generally has lower levels of use than older adolescent groups.

often occur during adolescence, and can help mitigate negative outcomes at both individual and societal levels.

One informative area of research in the area of adolescent substance use is the tracking of drug use rates and trends. Understanding current rates and trends in drug use provides researchers with a clearer view of the dynamics of substance use and can inform and direct prevention and treatment efforts. The Monitoring the Future (MTF) study is an annual substance use survey of American secondary students, college students, and young adults that has been conducted by Johnston, O'Malley, Bachman, and Shulenberg at the Institute for Social Research at the University of Michigan since 1975 (Johnston, O'Malley, Bachman, & Schulenberg, 2009b). MTF is a well-respected resource that provides valuable information regarding national rates and trends in substance use. Information from these surveys has been used to help inform a wide range of substance use research (Cleveland, Feinberg, Bontempo, & Greenberg, 2008; Galaif, Newcomb, Vega, & Krell, 2007; Hawkins, Catalano, & Arthur, 2002; Olds & Thombs, 2001; Windle, 2000;). Results from the 2011 MTF surveys indicate that 10.5%, 20.1%, and 26.2% of eighth, tenth, and twelfth grade adolescents, respectively, have used illicit drugs (including inhalants) within a month of completing the Monitoring the Future survey (Johnston, O'Malley, Bachman, & Schulenberg, 2012). Additionally, lifetime illicit drug use (including inhalants) of eighth, tenth, and twelfth graders was 26.4%, 40.8%, and 51.8%, respectively. While overall adolescent substance use rates had been declining since the mid-1990s, recent results from the MTF surveys indicate that declines that had been seen within the last decade have continued for some drugs, but have also reversed

for other drugs such as marijuana and ecstasy (Johnston et al., 2012). Overall, rates of adolescent substance use continue to occur at worrisome levels.

Review of the Literature

Given that early initiation of substance use by adolescents is one factor that is often associated with increased risk of more extensive and persistent future drug use (Hawkins et al., 2002), current levels of use by younger adolescents are particularly important when looking at drug use across adolescence. According to the 2011 MTF survey, approximately 18.4% of eighth grade students reported that they have tried cigarettes, 33.1% reported that they have consumed more than a few sips of alcohol by eighth grade, with 18% reporting that they had been drunk at least once in their lifetime (Johnston et al., 2012). Lifetime use of inhalants by eighth graders was reported at 13.1% (higher than the rate reported by tenth and twelfth graders); while 16.4% reported that they had used marijuana or hashish before (Johnston et al., 2012).

Adolescence substance use rates for many drugs had been declining since the mid-1990s; however, as noted earlier, some drugs such a marijuana and ecstasy have had increasing rates of use in the past 3 years. Johnston et al. (2009a) note that complacency could lead to future increases, just as it may have contributed to a significant rise in adolescent substance use that occurred in the early 1990s. Notwithstanding the gains that have been made since the mid-1990s, overall adolescent substance use in the U.S. continues to occur at detrimental levels (Johnston et al., 2009b; Office of National Drug Control Policy, 2004). In addition, Johnston et al. (2009c) note that recent decreases in perceived risk associated with marijuana, ecstasy, LSD, and inhalant use could be precursors to increased interest and possible use of these drugs. Johnston et al. (2009b)

succinctly summarize the need for continued emphasis on the problem of drug abuse when they note that it is "a recurring and relapsing problem that must be contained to the greatest extent possible on an ongoing basis." (2009b, p. 39). Based upon the recognition that adolescent drug use requires continued containment, a review of some of the research regarding substance abuse prevention is warranted.

Adolescent Substance Use Prevention: Risk and Protective Factors

While treating adolescents with current substance use problems is an important component in addressing current rates of adolescent substance use, problems such as high costs and difficulties with providing treatment services to all those who are in need of them are often cited as limitations (Hawkins, Catalano, & Miller, 1992). Prevention is one area that is often cited as an important component in addressing adolescent substance use. Results from recent research studies have shown that for every dollar that is spent on research-based substance abuse prevention programs up to 10 dollars in future treatment costs can be saved (NIDA, 2004). In order to better understand substance use prevention methodology, a brief discussion of one of the major theoretical perspectives that has influenced current substance use prevention practices follows.

The Social Development Model

Although there are a number of theoretical perspectives that have contributed to current substance use prevention research and practices, the *social development model* is the theoretical model that most clearly addresses the substance use prevention methods that will be discussed in this thesis. Catalano, Kosterman, Hawkins, Newcomb, and

Abbot (1996) provide the following definition of the social development model: "The social development model is a general theory of human behavior that seeks to explain antisocial behaviors through specification of predictive developmental relationships." (p. 429). Based upon theoretical concepts from control theory, social learning theory, and differential association theory (Catalano et al., 1996), the social development model asserts that relationships between an individual and his or her social environment have a strong effect upon that individual's development and behavior. Consequently, the model hypothesizes that an individual's behavior is greatly dependent upon the predominant belief systems, behaviors, and mores that are espoused by those with whom the individual is bonded (Catalano et al., 1996). This suggests that an individual who is attached or bonded to a group of individuals that engages in antisocial behaviors is likely to internalize the norms of this group and engage in the same or similar antisocial behaviors; conversely, an individual who is attached or bonded to a group of individuals that engages in prosocial behaviors is likely to internalize the norms of this group and participate in the same or similar prosocial behaviors. The social development model was established and based upon research that has examined the relationships between risk and protective factors and the development of antisocial behaviors (Catalano et al., 1996). Understanding the relationships between risk and protective factors and adolescent drug use has been the focus of many substance use prevention efforts and research studies (Arthur, Hawkins, Pollard, Catalano, & Baglioni, 2002; Cleveland et al., 2008; Hawkins et al., 1992; Hawkins et al., 2002; Henry, 2008; Galaif et al., 2007; Kaufman, Wyman, Forbes-Jones, & Barry, 2007; NIDA, 2004).

Risk and Protective Factors

Risk and protective factors are often measured and examined to assess relationships between unwanted behaviors, such as substance use, and factors that are likely to contribute to those behaviors. *Risk factors* are hazards, characteristics, or variables that, when present, increase the risk that an individual will develop a problem or disorder (Arthur et al., 2002). *Protective factors* are factors that directly or indirectly reduce the effects of risk factors, thus reducing the risk that an individual will develop a problem or disorder (Arthur et al., 2002).

Risk and protective factors are often organized within four general categories or domains: community, school, family, and individual/peer (Arthur et al., 2002). Research has shown that exposure to increasing numbers of risk factors is a strong predictor of behavioral difficulties or disorders, with researchers often concluding that multiple factors should be considered when addressing prevention (Arthur et al., 2002; Coie et al., 1993; Hawkins et al., 1992). In addition to reducing risk factors, increasing or promoting protective factors is one form of prevention that may be effective in reducing the likelihood of unhealthy behaviors (Coie et al., 1993; Hawkins et al., 1992). Promoting protective factors may inhibit the initial appearance of risk factors and moderate or reduce the effects of risk factors (Coie et al., 1993). Ultimately, a risk and protective factors approach to prevention seeks to decrease the effects of risk factors in an adolescent's life, while also increasing the positive effects of protective factors as well (Hawkins et al., 1992).

The method of identifying and attempting to modify risk and protective factors is a method that has been recommended by multiple researchers (Arthur et al., 2002;

Hawkins et al., 2002; NIDA, 2004). Research studies have confirmed the effectiveness of programs that target a variety of risk and protective factors such as students' beliefs about drug norms, social acceptability of drug use, personal and social competence skills, academic failure, and positive bonding to school and family (Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995; Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003; Griffin, Botvin, Nichols, & Doyle, 2003; Hawkins et al., 2002; O'Donnell, Hawkins, Catalano, Abbott, & Day, 1995;).

As Hawkins et al. (1992) reported, it is often difficult or unfeasible to control many of the risk and protective factors that are associated with adolescent substance use; consequently, they recommended that more easily manipulated factors that mediate or moderate the effects of risk factors be identified and utilized to improve the prevention of adolescent substance use. While mediation and moderation are two research concepts that can easily be misunderstood (Frazier, Tix, & Baron, 2004), both have the potential to provide important information that can inform research, prevention, and intervention efforts. Frazier et al. (2004) define a *moderator* as "a variable that alters the direction or strength of the relation between a predictor and an outcome." (p. 116). As a hypothetical example, suppose that family history of alcoholism is highly correlated with adolescent drug use, and in addition, the strength of this relationship varies based upon the gender of the adolescent. Gender would be the moderator in this example. Frazier, Tix, and Baron (2004) also define a *mediator* as "a variable that explains the relation between a predictor and an outcome." (p. 116). A hypothetical example might be: if a family history of alcoholism leads to high levels of neglect, which in turn contributes to adolescent drug use, then the mediator in this example would be level of neglect. Analyzing moderator

and mediator relationships between variables can contribute to better understanding of how and why some variables are associated with substance use, which in turn can improve efforts to address these relationships.

Targeting particularly significant factors at optimal developmental stages, adjusting methods to the needs of individual communities, and recognizing individual differences that may moderate the effectiveness of some factors can lead to improved outcomes and more efficient uses of resources in substance use prevention programming (Hawkins et al. 2002; 1992; NIDA, 2004). For example, in 2008 Cleveland et al. analyzed cross-sectional survey data from 91,778 students in grades 6, 8, 10, and 12. The analysis found that family and community factors were stronger predictors of recent or lifetime substance use for younger adolescents than they were for older adolescents. They also found that peer and school factors were stronger predictors of recent and lifetime substance use for older adolescents than they were for younger adolescents. A study by Wills, McNamara, and Vaccaro (1995) found that adolescents from families with lower education levels were more vulnerable to substance use risk factors such as negative life events and friends' beer or wine use; however, they also found that this group also benefited more from protective factors such as emotional support, academic competence, and behavioral competence. These two studies illustrate that risk and protective factors often have moderators (i.e., developmental stage or family education levels) that can influence the effectiveness of an intervention. Better identification and understanding of moderating factors assist professionals with improving current and future prevention and treatment services.

Peer Substance Use

One risk factor that is often associated with adolescent substance use is peer influence through peer substance use. The relationship between peer substance use and adolescents' own individual substance use has been analyzed in multiple studies and reviews of studies, with results clearly indicating that there is a strong positive relationship between these two factors (Cleveland et al., 2008; Ennett et al. 2006; Galea, et al., 2004; Olds & Thombs, 2001; Steinberg, Fletcher, & Darling, 1994; Windle, 2000). While some might assert that the relationship between peer substance use and adolescents' own individual use is self-evident, a clearer understanding of this relationship provides researchers and other professionals with empirical data that improve research and prevention efforts. A closer examination of this relationship and how it relates to prevention of substance use follows.

Duncan, Tildesley, Duncan, and Hops (1995) conducted a 4-year research study of the substance use of 345 adolescents between the ages of 11 and 18 years old. They found that initial adolescent tobacco, alcohol, and marijuana use were strongly affected by peer influence, and that continued high levels of use were also associated with peer influence. A research study conducted by Dishion and Owen (2002) analyzed the relationship between deviant friendships, which were defined as friendships that actively encouraged delinquent or antisocial behavior, and individual adolescent substance use. This study utilized 206 participants from the Oregon Youth Study and their friends beginning at the ages of 13-14 up until the ages of 22-23 years old. Parent and child interviews, videotaped interactions, school data, and court records were all used to assess the relationship between adolescent substance use and deviant friendship. Dishion and

Owen found that the tendency to cluster into peer groups that use drugs was the strongest correlate of individual adolescent substance use. In addition, they found that drug use connected individuals within peer groups in a manner that may have facilitated deviant relationships and peer interactions within the groups. Results from these research studies indicate that both initiation and continued use of drugs by adolescents are correlated with peer substance use.

In 2006, Ennett et al. analyzed the relationship between adolescent substance use and peer social networks. In this study, 5,104 sixth, seventh, and eighth graders were surveyed every 6 months over the course of approximately 2 years. Adolescents had a greater likelihood of using alcohol, cigarettes, or marijuana when their best friend reported use, when more friends within their social network reported use, and when there was closer social proximity to a substance user (even if the substance user was not among the adolescent's set of friends). Results also indicated that adolescents at the extremes of either high or low social embeddedness were more likely to use substances than those found in the middle. Results from this study indicate that adolescent drug use is correlated to friends' substance use, and that social proximity and embeddedness are two mechanisms that may mediate this correlation.

In a cross-sectional study conducted by Lundborg (2006), 3,027 Swedish adolescents from the ages of 12 to 18 years old were surveyed to examine the effect of peer relationships, specifically within the classroom setting, on adolescent binge drinking, smoking, and illicit drug use. Significant and positive relationships between peer effects and all three of the substances were found, with the magnitude of the peer effect being the largest for binge drinking, and the smallest for illicit drug use. Lundborg

notes that the higher magnitude was found to occur with the most common behavior, binge drinking, while the smallest occurred with the least common behavior, illicit drug use. While not explicitly noted in much of the research conducted on the relationship between peer substance use and adolescent substance use, it is likely that a significant portion of peer influence that is measured in many of these research studies occurs within, or associated with, the school setting.

Additional research conducted with minority populations has also demonstrated that adolescent associations with peers who use drugs increase the likelihood that adolescents from minority populations will also use drugs. A 1991 study of 526 ethnically diverse seventh graders conducted by Graham, Marks, and Hansen found that adolescent alcohol and tobacco use was positively correlated with peer substance use. In addition, three areas of peer influence were found to individually contribute to this correlation: active peer influence in the form explicit offers to use substances, passive influence in the form of social modeling, and overestimation of peer substance use. It is also interesting to note that adolescents with prior use were more affected by peer offers to use drugs than adolescents with no prior use. In a 2007 research study, Galaif et al. examined risk and protective factors associated with adolescent drug use utilizing an ethnically-diverse sample of White, U.S. and foreign-born Latino, and African American adolescent boys. They found a strong positive relationship between peer drug use and adolescent drug use across the ethnic groups included in the sample. In another study, utilizing a sample of inner-city, predominantly minority adolescents, Epstein, Botvin, and Doyle (2009) found that polydrug use was positively related to friends' smoking and use of alcohol. Frauenglass, Routh, Pantin, and Mason (1997) also examined this

relationship in a study that utilized a mostly Hispanic sample, and found that friends' substance use increased the likelihood of adolescent substance use among Hispanic youth.

As can be seen in research cited above, friends' substance use is highly correlated with adolescent substance use, and has been shown to occur across settings, across varying adolescent grade or age groups, and across multiple ethnic groups. While this correlation has strong empirical support, the underlying mechanisms associated with this correlation do not share the same level of consensus across research studies. Two important mechanisms that are often examined are peer influence and peer selection.

Peer Selection Versus Peer Influence

Peer influence and peer selection are two general areas that are often cited as fundamental contributors or mediators of the effects of peer substance use on adolescent substance use. *Peer influence* is the mechanism where the peer group causes or influences the individual adolescent's behavior, which in the context of this paper would be drug use (Ennett & Bauman, 1994). An example of this might be an adolescent who initiates use of marijuana as a result of peers normalizing the use of marijuana (i.e., lessening the adolescent's negative perception of marijuana use) and directly offering the drug to the adolescent. *Peer selection* occurs when the shared behavior of the adolescents in the group, which again in the context of this paper would be drug use or the contributing factors that may lead to drug use, causes the formation of a peer group that engages in drug use and reinforces the individual adolescent's drug use (Ennett & Bauman, 1994). An example of this might be a group of adolescents who have

previously experimented with marijuana use individually, who ultimately form a peer group that shares the desire to smoke marijuana and encourages drug use, which in turn increases the level of drug use by individuals within the group. Ennett and Bauman (1994) utilized a sample of 926 adolescents to study the homogeneity of cigarette smoking within adolescent peer groups and to analyze the effects of selection versus influence. Results from this study indicate that both selection and influence contributed to the homogeneity of cigarette smoking within adolescent peer groups. Wills and Cleary (1999) also conducted a study that examined the effects of peer-selection versus peer-influence on adolescent substance use. Two groups of sixth through ninth grade adolescents, 1,190 in the first and 1,277 in the second, completed self-report questionnaires once a year over the course of 3 years. Results from their analysis led Wills and Cleary to conclude that the positive relationship between peer substance use and adolescent substance use is likely due to the peer-influence mechanism rather than a peer-selection mechanism. Norton, Lindrooth, and Ennett (1998) similarly found that peer influence had a greater effect on adolescent substance use than the effect of peer selection. In contrast, Dishion and Owen (2002) attributed the greater part of adolescent use to peer selection rather than influence. Conflicting research findings such as these have made it difficult to determine whether the substance use of peers affects adolescent substance use through the mechanism of selection, influence, or a combination of both. Despite the difficulty in disentangling these concepts, as noted above, the general relationship between peer use and adolescent use is well established, and has been associated with a variety of other factors.

Additional Factors Associated With Peer Substance Use

Pomery et al. (2005) conducted a research study of 225 African American families that examined the influences of peers, parents, and older siblings on younger adolescent substance use. Results indicated that older siblings' willingness to use and peers' substance use predicted later use of substances by younger siblings. In addition, when older siblings' behavioral willingness to use substances was low, the association between peer influence and adolescent substance use was lessened, indicating that sibling relationships may act as a moderating factor. A study conducted by Windle (2000) also found that sibling substance use was positively correlated with adolescent substance use, and that this relationship was partially mediated by peer substance use. While results from these studies support previous findings regarding peer substance use and adolescent substance use, they also indicate that other individuals, such as siblings, may influence this relationship.

Henry (2008) conducted a research study that examined the relationships between adolescent substance use and poor family attachment, poor school attachment, and involvement with friends who use drugs. In this study 1,065 sixth and seventh graders who were in a no-treatment control group within a larger drug prevention study completed four surveys over the course of 2 years. Results indicated that the relationship between poor family attachment and adolescent substance use was mediated through poor school attachment and involvement with friends who use drugs. Additionally, the relationship between poor school attachment and adolescent substance use was mediated by involvement with friends who use drugs. The model of poor family attachment, poor school attachment, and involvement with friends who use drugs accounted for 33.6% of

the variance in cigarette scores, 29.6% of marijuana score variance, and 30.4% of the variance in alcohol scores. Results from this study indicate that other correlates such as family attachment and school attachment are areas that are likely associated with adolescent's involvement with friends who use drugs. A research study by Steinberg et al. (1994) examined the relationship between parental monitoring, peer influence, and adolescent substance use. In this study, 6,500 high school students from California and Wisconsin completed questionnaires that measured peer substance use and peer influence, parental monitoring, and substance use on two separate occasions over the course of 2 school years. Results indicated that parental monitoring was negatively related to adolescent substance use, while peer substance use was positively related to adolescent substance use. Interestingly, they also found that once adolescent boys initiated substance use their pattern of use became similar to their friends', and was not affected by levels of parental monitoring. In contrast, once adolescent girls initiated substance use their pattern of use was influenced by parental monitoring as well as by their friends' substance use. This study provides another example of factors that may contribute to, or decrease the influence of, peer substance use and adolescent use.

Factors such as sibling drug use, attachment to home, attachment to school, and parental monitoring are examples of factors that likely mediate or moderate the correlation between friends' substance use and adolescent drug use. Understanding how these and other factors affect this relationship can inform research and prevention efforts. One promising area that may lend itself to improved research and prevention is prosocial involvement.

Prosocial Involvement

Hawkins et al. (1992) acknowledge that *prosocial involvement* is an important method whereby attachment to family, school and other institutions can be facilitated. Broadly defined, prosocial involvement is the act of engaging in activities, programs, and affiliations that require and promote prosocial interactions and relationships. Examples of prosocial involvement include participation in sports, educational activities, arts, clubs, family discussions, family activities, service projects, community organizations, or other similar activities that are likely to promote prosocial engagement.

Kaufman, Wyman, Forbes-Jones, and Barry conducted a 2007 research study that examined the relationships between prosocial involvement, antisocial peer affiliation, and antisocial behavior. The study consisted of 167 urban adolescents, a majority of whom were African American, who had been identified as having high lifetime exposure to psychosocial adversity. Participants were assessed at the ages of 9 to 11 years old, and 4 years later at the ages of 13 to 15 years old. Results indicated that prosocial involvement at the ages of 13-15 had a modest negative correlation with antisocial peer affiliations, while antisocial peer affiliations were associated with higher conduct problems and delinquent behaviors. In addition, prosocial involvement predicted modestly lower rates of delinquency, and had a protective effect in that adolescents with high prosocial involvement had a decreased relationship between antisocial peer affiliations and delinquent behavior. Kaufman et al. (2007) also found that prosocial involvement and "antisocial peer affiliations" did not "represent opposite ends of a single continuum of peer influences." (p. 430). Essentially, the results indicated that peer social networks are heterogeneous and do not represent a dichotomous choice between solely prosocial or

antisocial peer affiliations. Kaufman et al. (2007) were also surprised to find that urban youth who had experienced a wide variety of psychosocial difficulties were able to participate in organized activities at a higher rate than they had anticipated. The potential protective effect of prosocial involvement on delinquent behavior indicates that prosocial involvement may also protect against more specific problem behaviors such as drug use. In light of these findings, examining the relationship between the possible protective effect of prosocial involvement and the relationship between peer substance use and adolescent substance use may be informative.

Research Questions

Evidence from a wide range of research studies cited within this paper (e.g., Henry, 2008; Kaufman et al., 2007; Steinberg et al., 1994; Windle, 2000) indicates that risk and protective factors provide a variety of potential opportunities for intervening and preventing adolescent substance use. The relationship between peer substance use and adolescent substance use has been analyzed in multiple studies with results clearly indicating that there is a strong positive relationship between these two factors (Cleveland et al., 2008; Ennett et al. 2006; Galea et al., 2004; Olds & Thombs, 2001; Steinberg et al., 1994; Windle, 2000). Attenuating this relationship could potentially decrease rates of adolescent substance use and promote stronger attachment to prosocial institutions and individuals.

Eighth grade adolescents are the target population that was examined in the analysis. An eighth grade population rather than an older adolescent population was examined based upon the following factors: First, given that substance use rates of

younger adolescents are lower than those of older adolescents (Johnston et al., 2009a), efforts that target younger populations provide greater opportunity for prevention. Second, younger adolescents are at an age when experimentation with drug use begins to occur more frequently (Griffin et al., 2003). Finally, early initiation of drug use has been shown to be highly correlated with later substance abuse and dependence, and can effectively be addressed by prevention programs (Hawkins et al., 2002).

Prosocial involvement is a factor that lends itself to manipulation, is often well-established, is relatively easily accessible, and can be found across settings. As noted by Kaufman et al. (2007), prosocial involvement may reduce opportunities for adolescents to participate in delinquent behaviors with peers, expand social networks with prosocial peers, provide a feeling of competence due to opportunities for success, increase relational bonding and emotional support with adults, and augment bonding to conventional societal norms. These aspects of prosocial involvement, as well as increased adolescent supervision and the ability to intervene across settings, may also contribute to the overall moderating effect of prosocial involvement on the relationship between peer substance use and adolescent substance use. This study examined the relationship between these factors and adolescent substance use. The research questions were as follows:

1) Do higher levels of opportunities and rewards for prosocial involvement within the school setting moderate the relationship between eighth grade adolescent substance use and involvement with drug-using friends?

Multiple research studies have found a strong positive relationship between adolescent substance use and involvement with drug-using peers (Cleveland et al., 2008;

Ennett et al. 2006; Galea et al., 2004; Olds & Thombs, 2001; Steinberg et al., 1994; Windle, 2000); However, the following prosocial factors that are often found within the school setting have the potential to attenuate this relationship: reduced opportunities for adolescents to participate in delinquent behaviors with peers, expanded social networks with prosocial peers, increased feelings of competence due to opportunities for success, increased relational bonding and emotional support with adults, and improved bonding to conventional societal norms (Kaufman et al. 2007). Kaufman et al. (2007) also found that prosocial involvement predicted modestly lower rates of delinquency, and had a protective effect in that adolescents with high prosocial involvement had a decreased relationship between antisocial peer affiliations and delinquent behavior. While school prosocial environment is not a direct measure of prosocial involvement, it is reasonable to associate an environment that provides a greater number of opportunities and rewards for prosocial involvement as one that would foster increased prosocial involvement. It was also determined that examining the prosocial environment within the context of the school setting was important due in part to the data being collected within the school setting, the high rate and variety of peer interactions that occur within this setting, as well as the increased opportunity for prevention efforts that may be more readily implemented within a school setting. Based upon the literature review, it was predicted that higher levels of school prosocial environment would weaken the positive relationship between individual eighth grade adolescent substance use and involvement with drug-using friends; Nevertheless, it was noted that due in part to the strength of the relationship between adolescent substance use and involvement with drug-using friends, the strength of moderation would be relatively modest.

2) Do higher levels of opportunities and rewards for prosocial involvement within the settings of school, family and community moderate the relationship between eighth grade adolescent substance use and involvement with drug-using friends? If so, which of the domains (school, family, or community) produce greater moderating effects?

Based in part upon research literature that found high correlations between peer influence and adolescent substance use (Dishion & Owen, 2002; Duncan et al., 1995; Ennett & Bauman, 1994; Graham et al., 1991), it was hypothesized that the community and school settings would produce a stronger moderating effect than the family setting. This hypothesis was based upon the rationale that these two settings would likely produce stronger moderating effects on adolescent drug use due in part to the perception that prosocial activities and rewards within these settings would provide greater opportunities for interaction and bonding with prosocial peers. However, it was noted that due in part to overlapping that likely occurs between domains, the strength of these differences would be relatively small.

CHAPTER II

METHODOLOGY

Participants

The current analysis utilized data collected from the 2007 Prevention Needs Assessment (PNA) questionnaire, which is one of two questionnaires that form the 2007 Student Health and Risk Prevention (SHARP) Survey. The PNA survey has been administered every 2 years since 2003. The 2007 PNA survey was administered to a total of 62,964 students in grades 6 through 12 in 38 school districts as well as 10 charter schools across a state located in the western region of the United States during February and March of 2007. Of these surveys, 3,373 (5.4%) were eliminated from the analyses due to validity reasons as indicated by the following. First, students were asked if they had been honest in completing the survey. If respondents indicated that they were "Not Honest At All" in completing the survey they were eliminated from the sample (553 students). Second, the students were asked if they had used a nonexistent drug called phenoxydine. Those students who indicated that they had used phenoxydine were removed from the sample (2,159 students). Students were also removed from the analysis if they reported an impossibly high level of drug use (867 students), or if they indicated past-month use rates that were higher than lifetime use rates (1,768 students).

Finally, if the students reported an age that was inconsistent with their grade or their school they were also removed from the sample (174 students).

Of this total sample that met validity criteria, 13,367 eighth grade (the targeted grade for this analysis) students completed the survey. A total of 51.5% of eighth grade respondents were female, while 48.5% were male. The majority of eighth grade respondents identified themselves as White (69.0%), 10.5% self-identified as Hispanic, 9.9% identified themselves as either African American, Asian or Pacific Islander, or Native American, 3.0% indicated they were multiracial, and 7.6% reported their race as "unknown." Surveys from schools that had less than 10 participants in a school were removed from the sample. Listwise deletion was also utilized to remove cases that contained missing data on the variables included in the analysis. A total of 10,767 student surveys met criteria and were utilized in the analyses.

Instrument, Procedure, and Setting

Coordination and administration of the 2007 PNA Survey was conducted through a collaborative effort between the western state's Department of Human Services, Division of Substance Abuse and Mental Health; Office of Education; Department of Health; and Bach Harrison, L.L.C. The western state's Department of Human Services, Division of Substance Abuse and Mental Health granted permission to utilize data from the 2007 PNA Survey to conduct this analysis. In addition, the current research study received approval from the University of Utah Institutional Review Board.

The PNA survey is based upon the Communities That Care Youth Survey (see Arthur et al., 2002) that was developed to:

> (a) assess a broad set of risk and protective factors identified by prospective longitudinal research across the domains of community, school, family, peer, and individual as well as health and behavior outcomes, including substance use, violence, and delinquency; (b) be administered within a school setting during one class period (approximately 50 minutes); and (c) be appropriate for adolescents ranging in age from 11 to 18 to allow for assessment of levels of risk and protective factor exposure at difference ages during adolescence. The risk and protective factors selected for inclusion were factors that had been found to predict drug use and delinquent behavior at the individual level in two or more longitudinal studies in which the factors were measured prior to the outcomes of interest. (pp. 577-578)

The authors of the PNA survey ensured that the strong psychometric properties that were rigorously established in the development and validation of the Communities that Care Youth Survey were maintained (see Arthur et al., 2002 for a thorough review of the procedures and development of the Communities that Care Youth Survey).

Current state law required that active parent permission was obtained for each child who completed the 2007 PNA Survey. Every student who was selected to complete the 2007 PNA Survey was given a parental consent form and parents were required to give permission prior to survey administration. Parents were told their student's participation was voluntary and were given the option to decline to participate if they desired. If a parent declined, their son or daughter was allowed to read or participate in an alternate activity while his or her classmates completed the survey.

Once parental consent was received, students were asked to complete the 2007 PNA Survey. The survey consisted of 141 questions, but many of the questions had multiple components, so the actual number of items students were asked to complete was 238. Classroom teachers provided blank survey booklets to students during one of their regularly scheduled class periods. The classroom teacher explained the administration procedures, taking particular care to explain the anonymous and confidential nature of the

survey. While completing the survey, students were arranged in the classroom so their responses could not be seen by the teacher administering the survey or by any other students within the classroom. Students were given approximately 45 minutes to complete the surveys, and teachers were instructed to inform students that they should answer as many questions as possible during the class but should not be concerned if they were unable to finish all of them in the allotted time. At the end of the class period, the survey booklets were immediately gathered, placed in a box, sealed and mailed to Bach Harrison, L.L.C.

Variables

The 2007 PNA Survey measures a variety of risk and protective factors that are organized into scales as well as multiple demographic variables. The following section describes each of the variables that were used in the current study, provides information about the questions that are used to construct each variable, and lists the psychometric properties of each of the variables.

Adolescent Drug Use

This scale was measured by asking adolescents what substances they had used within the past 30 days. Substances included in this measure were alcohol, cigarettes, marijuana, and inhalants. Alcohol, marijuana, and cigarettes were selected for measurement due to their higher prevalence of use than other drugs. Inhalant use was also included in this measure due to the prevalence of eighth grade adolescent use. Unlike most other drugs, inhalant use occurs at a higher rate with younger adolescents

than it does for older adolescents, and use by eighth graders is higher than use by tenth and twelfth (Johnston et al., 2009a). Internal consistency information on this scale can be found in Table 1. A full list of the four adolescent drug use variable items can be found in the Appendix. The following is an example of one of the questions used in this scale: "On how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil) during the past 30 days?" Possible responses to this question were: 0 occasions, 1-2, 3-5, 6-9, 10-19, 20-39, or 40 or more.

Friends' Drug Use

This scale asked the adolescents to report the use of alcohol, cigarettes, marijuana, or other illicit drugs by their four best friends within the previous 12 months. Internal consistency information on this scale can be found in Table 1. A full list of the four friends'drug use variable items can be found in the Appendix. The following is an example of one of the questions used in this scale: "Think of your four best friends (the friends you feel closest to). In the past year (12 months), how many of your best friends have: Tried beer, wine or hard liquor (for example, vodka, whiskey or gin) regularly?" There were five possible responses: 0, 1, 2, 3, or 4.

Table 1

Scale Reliability (Cronbach Alpha) for Research Variables

Variable	Cronbach Alpha
School Prosocial Environment	.80
Family Prosocial Environment	.88
Community Prosocial Environment	.81
Friends' Drug Use	.88
Adolescent Drug Use	.86

School Prosocial Environment

This scale asked adolescents questions about the availability of prosocial activities within their schools as well as rewards for being engaged in prosocial school activities, and is composed of seven items. Internal consistency information on this scale can be found in Table 1. A full list of the nine school prosocial environment variable items can be found in the Appendix. The following is an example of one of the questions used in this scale: "My teacher(s) praise me when I work hard in school." The possible responses for this question are "NO!", "no," "yes," or "YES!" Students were given instructions that indicated that their answers meant the following on the survey: "NO!" meant *definitely not true for him/her*, "no" meant *mostly not true for him/her*, "yes" meant *mostly true for him/her*, and "YES!" meant *definitely true for him/her*.

Community Prosocial Environment

This scale asked adolescents questions regarding the availability of prosocial activities within their communities as well as rewards for being engaged in prosocial community activities, and is composed of nine items. Internal consistency information on this variable can be found in Table 1. A full list of the nine community prosocial environment variable items can be found in the Appendix. The following is an example of one of the questions used in this scale: "There are people in my neighborhood who encourage me to do my best." The possible responses for this question are: "NO!", "no," "yes," or "YES!" Students were given instructions that indicated that their answers meant the following on the survey: "NO!" meant *definitely not true for him/her*, "no" meant

mostly not true for him/her, "yes" meant *mostly true for him/her*, and "YES!" meant *definitely true for him/her*.

Family Prosocial Environment

This scale asked adolescents questions about the availability of prosocial activities within their families as well as rewards for being engaged in prosocial family activities, and is composed of seven items. Internal consistency information on this variable can be found in Table 1. A full list of the seven family prosocial environment variable items and responses can be found in the Appendix. The following is an example of one of the questions used in this scale: "If I had a personal problem, I could ask my mom or dad for help." The possible responses for this question are: "NO!", "no," "yes," or "YES!" Students were given instructions that indicated that their answers meant the following on the survey: "NO!" meant *definitely not true for him/her*, "no" meant *mostly not true for him/her*, "yes" meant *mostly true for him/her*, and "YES!" meant *definitely true for him/her*.

Study Design

This study was a secondary data analysis of an extant data set of eighth grade students within different schools in one state. Due to the original design of the survey, it was determined that the data were nested. Nested data requires a statistical model that takes into account this hierarchical structure. In this study, students (level 1) were considered to be nested in their school (level 2). For example, students in the same school are likely to be more similar to one another on many variables when compared to

individuals in other schools, which means that observations are no longer independent from one another and can introduce a source of bias into an analysis (Heck, Thomas, & Tabata, 2010). The similarities within each school violate the assumptions of random sampling and independence in a single-level analysis, which can lead to underestimated variances and standard errors that may lead to inaccurate results (Heck et al., 2010).

Due to the nested structure of the data, multilevel modeling was initially utilized to analyze individual-level and school-level differences in the variables being examined. Multilevel statistical analyses were conducted in both SAS and HLM to determine if significant differences in student reported substance existed between schools. In addition, both robust standard errors (SAS analysis) and the Poisson function (HLM analysis) were utilized in the multilevel statistical analyses to address the two positively skewed variables ("adolescents' past 30 day drug use" and "Friends' drug use within the past 12 months"). While results from both analyses indicated that statistically significant differences did exist between schools, the ICC score (see additional information regarding the ICC below in the "Results" section) was well below generally accepted cut-off scores that are often used in multilevel analyses (Heck et al., 2010). The low ICC score indicated that higher level grouping did not significantly affect estimates, meaning that very little variance in the dependent variable (eighth grade adolescent drug use) was explained through the grouping structure of schools. Based upon these findings, multilevel modeling was no longer a viable analytical method for this study. These results led to a reconfiguration of the analysis. The final analytic method used was a single-level logistic regression analysis that was conducted in SPSS. A comprehensive

description of the analytical techniques and methodologies utilized in this study can be found within the results section below.

CHAPTER III

RESULTS

Overview of the Analyses

The research questions for the current research study were initially analyzed utilizing multilevel modeling. The first analyses used a nested design that nested students (level 1) within schools (level 2). The dependent variable for both research questions was adolescents' overall past 30 day drug use of the following four drug types: cigarettes, alcohol, marijuana, and inhalants. After conducting multilevel statistical analyses in both SAS and HLM, it was determined that higher level grouping did not significantly affect estimates, which led to a reconfiguration of the analysis. The final analytic method used was a single-level logistic regression analysis that was conducted in SPSS. The following three statistical software programs were used to conduct the necessary statistical analyses for this study: SPSS, SAS, and HLM.

Single-level logistic regression analyses were conducted in SPSS to answer both of the main research questions that were examined in this study. Logistic regression is an analytic method that is typically used to test hypotheses about relationships between a categorical outcome variable and one or more predictor variables (Peng, Lee, & Ingersoll, 2002). Due to the highly skewed nature of the dependent variable (eighth grade

adolescents' past 30 day drug use), the dependent variable was converted into a dichotomized categorical variable that indicated either that the student had reported drug use within the prior 30 days (coded as "1"), or had not reported use within the past 30 days (coded as "0"). See the "Single-level Logistic Regression Analyses" section for specific information regarding the logistic regression analyses.

Data Screening

Data were examined for accuracy and to ensure that necessary assumptions were met based upon each analytical method that was used (Heck et al., 2010; Leech, Barrett, & Morgan, 2008). Listwise deletion was used to remove cases that contained missing data on the variables that were included in the study. A total of 10,767 out of the initial 13,367 participants were used in the analysis. One of the main problems associated with listwise deletion is a loss of power; however, the large number of subjects and schools in this study likely compensated for any loss of power that resulted from listwise deletions of cases.

Multilevel modeling is one of many forms of statistical analyses that make the assumption that variables are normally distributed, which in turn requires that data that are analyzed utilizing these methods be reasonably normally distributed (Heck et al., 2010; Leech et al., 2008). Analyses that utilize skewed datasets may produce biased estimates that could nullify the results of the analyses. An analysis of the data distributions of each variable within this study indicated that two variables, adolescent substance use within the past 30 days, and friends' substance use, were significantly positively skewed (see Table 2). Leech et al. (2008) recommend the general guideline of

skewness that is plus or minus one as a requirement for the normality assumption. As one can see in Table 2 the adolescent substance use and friends' substance use skewness are much higher than plus or minus 1 (6.27 and 2.67, respectively). Substance abuse researchers often encounter skewed datasets due in part to the relatively low rates of use when analyzing general populations and several researchers have utilized data transformations to correct for skewed data (Botvin et al., 2000; Dishion & Owen, 2002; Parsai, Marsiglia, & Kulis, 2010). Two data transformations were conducted on the dataset in SPSS, and the resulting skewness scores can be found in Table 3. Despite improvements, skewness scores continued to remain at unacceptable levels. Other researchers have utilized robust standard errors in their analyses in order to account for skewed drug use distributions (Henry, 2010; Henry et al., 2009). Robust standard errors were used in the first multilevel analysis in order to account for the skewed distribution of the adolescent drug use and friends' drug use variables.

Table 2

Variable Means, Standard Deviations, and Skewness

Variable	Mean	Standard Deviation	Skewness
School Prosocial Environment	25.08	4.20	-0.38
Family Prosocial Environment	22.49	4.62	-0.83
Community Prosocial Environment	19.02	4.24	-0.33
Friends' Drug Use	5.41	3.01	2.67
Adolescent Drug Use	4.28	1.12	6.27

Descriptive Statistics

Participants in this study consisted of eighth grade students in a western state who completed the 2007 Student Health and Risk Prevention (SHARP) Survey. The final sample utilized in the single-level logistic regression analyses consisted of 10,767 participant surveys, participants were 47.2% male and 52.8% female, within a total of 43 schools. Information regarding variable means, standard deviations, and score ranges can be found in Table 4.

Table 3

Skewed Variable Data Transformations

Variable	Skewness	Skewness After LG10(X) Transformation	Skewness After 1/X Transformation
Friends' Drug Use	2.67	1.90	-1.44
Adolescent Drug Use	6.27	4.43	-3.53

Table 4

Mean, Standard Deviation, and Score Range of Variables

Variable	Mean	Standard Deviation	Score Range
School Prosocial Environment	25.14	4.18	9-36
Family Prosocial Environment	22.57	4.58	7-28
Community Prosocial Environment	19.08	4.20	9-26
Friends' Drug Use	5.32	2.89	4-20
Adolescent Drug Use (Dichotomized)	0.11	0.31	0-1

Prosocial environment score ranges were different for each scale. Lower scores indicate lower levels of perceived prosocial opportunities and rewards within the environment, while higher scores indicated higher levels of perceived prosocial opportunities and rewards within the environment.

Multilevel Analyses

As noted earlier, the current dataset has a significant positive skew. Transformations were attempted on the current dataset: however, the data continued to remain significantly positively skewed. Chen, Ender, Mitchell, and Wells (2003) noted that robust standard errors can be used to address concerns about a variety of failures to meet assumptions, with one of those being the failure to meet the assumption of normality. Other researchers have utilized robust standard errors in their analyses in order to account for skewed distributions (Henry et al., 2009; Henry, 2010). Robust standard errors were used in this SAS multilevel analysis in order to account for the skewed distribution of the adolescent drug use and friends' drug use variables.

An unconditional means model was initially conducted in SAS to calculate the proportion of variability in the dependent variable (e.g., adolescent drug use) that exists between Level 2 units (e.g., schools). Results from the unconditional means model indicated that a significant difference in adolescent drug use means between schools existed. An intraclass correlation (ICC) was also calculated at this point. Heck et al. (2010) noted that the ICC "describes the proportion of variance that is common to each unit, as opposed to variation that is associated with individuals within their units." (pp. 73-74). Essentially, ICC is an estimate of the amount of variance in the outcome unit, which in this case would be adolescent drug use, that is explained by the grouping structure (schools). Heck et al. also described the ICC as "the ratio of between-groups variance to the total variance" (p. 74). The ICC was calculated, and was found to be very small (ICC = .006). Researchers often use 0.05 as a general cutoff score to determine whether or not higher-level analyses meaningfully affect estimates (Heck et al., 2010).

Based upon these criteria, it was determined that additional multilevel analyses conducted in SAS would not be utilized for this research study due to the low ICC score, which indicates that further analyses and results would not provide meaningful information regarding the current research questions.

While Chen et al. (2003) did note that robust standard errors can be used to address concerns about a failure to meet the assumption of normality, they also indicated that this method should be used with minor concerns. Given the highly skewed nature of the dataset, the unsuccessful attempts to transform the data, and concerns that the skewed distribution may have been at a level that did not lend itself to utilizing the robust standard error option in SAS, it was determined that another method of analysis should be used to ensure that the previous multilevel analysis in SAS produced accurate results. Due to these concerns, an analysis was also conducted in HLM in order to use the Poisson function. A Poisson distribution is a distribution that is often used for datasets that utilize count data that are significantly positively skewed (Anderson, 2002). Given that the dependent variable adolescent drug use is a count of the number of times the adolescent reported using drugs within the past 30 days prior to the survey administration date, and that the resulting dataset is significantly skewed, it was determined that an analysis conducted with the Poisson link function in HLM would be the most appropriate method of analysis (Anderson, 2002). Results from the HLM analysis confirmed the results from the multilevel analysis in SAS. The analysis found that there were no statistically significant differences among schools in mean drug use, indicating that further level 2 analyses would not produce meaningful results.

Single-level Logistic Regression Analyses

Results from the multilevel analyses conducted with SAS and HLM statistical software indicated that another method of analysis would be more appropriate. The final analytic method used was single-level logistic regression that was conducted in SPSS. Logistic regression was used to assess the relationship between the dependent variable (eighth grade adolescent drug use) and the four predictor variables (friends' drug use, school prosocial environment, family prosocial environment, and community prosocial environment) as well as any potential interactions between predictor variables (i.e., moderators). The dependent variable in the logistic regression analyses remained student drug use within the last 30 days; however, the responses were recoded to reflect a dichotomized variable (0= no drug use within the past 30 day, 1=drug use within the past 30 days), which was necessary for this particular analysis. The predictor or independent variables for research question 1 were (1) friends' drug use within the past 12 months and (2) school prosocial environment. The predictor or independent variables for research question 2 included (1) friends' drug use within the past 12 months, (2) school prosocial environment, (3) family prosocial environment, and (4) community prosocial environment. All of the predictor variables that were included in the logistic regression analyses were converted into categorical variables to facilitate interpretation. Scores were categorized (i.e., "Low," "Medium," etc.) based upon the number of items found within the scale, the nature of the questions and responses, and the theoretical construct of the variable. For example, Family prosocial environment contained 7 items. Each of the 7 questions that were found within this variable were coded from 1 to 4, with 1 being

the lowest level for each item, and 4 being the highest level. See Table 5 for the category score ranges found within each of the predictor variables.

Research Question 1

The first logistic regression analysis was conducted in order to answer Research Question 1, which asked whether or not prosocial environment within the school setting moderates the relationship between eighth grade adolescent substance use and involvement with drug-using friends. This analysis was a combined logistic regression analysis that assessed whether the predictor variables school prosocial environment and friends' drug use significantly predicted whether or not a student had used drugs (tobacco, alcohol, marijuana, and/or inhalants) in the last 30 days. In addition, the analysis included an interaction variable to determine if school prosocial environment was a moderator within the relationship between friends' drug use and eighth grade adolescent drug use. The assumptions of observations being independent and independent variables being linearly related were checked and were found to be acceptable in this analysis as well as in each of the analyses that were conducted (Leech et al., 2011).

When friends' drug use, school prosocial environment, and the interaction variable of friends' drug use by School prosocial environment were considered together in a combined analysis, they significantly predicted whether or not a student used drugs in the past 30 days ($\chi^2 = 2341.59$, $df = 11$, N = 10767, $p < .001$). Table 6 presents results from this analysis. Overall, friends' drug use was found to be a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days. In addition, the odds

Table 5

Independent Variable Category Score Ranges

Variable	None	Low	Medium	High
School prosocial environment	N/A	9-18	19-27	28-36
Family prosocial environment	N/A	7-14	15-21	22-28
Community Prosocial Environment	N/A	9-13	14-22	23-26
Friends' drug use	4	5-8	9-12	13-20

ratio scores for each level of friends' drug use suggest that the odds of an eighth grade adolescent using drugs increase as friends' drug use scores increase. Odds ratio scores indicate that within this sample the likelihood of a student who had reported a low level of friends' drug use to have reported using drugs within the past 30 days was 7.57 times that of students who reported no friends' drug use. Students who reported medium or high levels of friends' use were 20.87 and 34.10 times as likely, respectively, to have reported using drugs within the past 30 days compared to students who reported no friends' drug use.

Overall, school prosocial environment was also found to be a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days (see Table 6). The odds of a student using drugs within the past 30 days who reported a medium level of prosocial school environment were .46 times the odds of those students who reported a low level of school prosocial environment, which is a reduction in the likelihood of reported drug use. The odds of students who reported high levels of school

Table 6

Combined Logistic Regression Predicting Adolescent Drug Use in the Past 30 Days: Friends' Drug Use, School Prosocial Environment, and Interaction Variables

Variable	*B*	*SE*	Odds ratio	*p*
Friends' Drug Use Overall	-	-	-	.000*
Low	2.02	.31	7.57	.000*
Medium	3.04	.35	20.87	.000*
High	3.53	.34	34.10	.000*
School Prosocial Overall	-	-	-	.000*
Medium	-.77	.28	.46	.006*
High	-1.37	.32	.25	.000*
Friends' Drug Use by School Prosocial Overall	-	-	-	.246
Medium Prosocial*High Friends' Drug Use	.80	.45	2.24	.074
High Prosocial*High Friends' Drug Use	1.20	.46	3.30	.010*
Medium Prosocial*Medium Friends' Drug Use	.56	.38	1.75	.134
High Prosocial*Medium Friends' Drug Use	.81	.45	2.24	.074
Medium Prosocial*Low	.376	.33	1.46	.257
High Prosocial*Low	.66	.38	1.94	.084
Constant	-2.99	.27	.05	.000

*Statistically significant

prosocial environment using drugs within the past 30 days were .25 times the odds that were reported by students who reported a low level of school prosocial environment, which also indicates a reduction in the likelihood of reported drug use. These results indicate that a higher score on school prosocial environment appeared to act as a protective factor by diminishing the odds of eighth grade adolescent drug use.

The overall interaction between friends' drug use and school prosocial environment was not found to be statistically significant (p = .246). The interaction between a high level of school prosocial environment and a high level of friends' drug use was the only interaction variable that was found to be statistically significant (p = .010). Results from this variable indicate that students who reported a High level of school prosocial environment and a High level of friends' drug use had increased odds of drug use within the past 30 days (3.30 times greater odds) when compared to students who reported a low level of school prosocial environment and no friends' drug use. Overall, the lack of statistical significance and the odds ratio scores indicate that school prosocial environment did not significantly moderate the relationship between friends' drug use and individual adolescent drug use within this analysis.

Results from Block 0 of the analysis, which is a section of the analysis that did not include any of the predictor variables, indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct for 89.1% of the sample. In Block 1, when friends' drug use, school prosocial environment, and friends' drug use by school prosocial environment were all included in the analysis, the prediction accuracy rate increased to 90.3%. The small increase in accuracy indicates that while the results were statistically significant,

the combined model only slightly increased the overall ability to accurately predict whether or not eighth grade students had use drugs within the past 30 days. It is important to note that the relatively small percentage of students who had used drugs within the past 30 days may have increased the difficulty in accurately predicting drug use within this sample. Notwithstanding the relatively small increase in accuracy, an increase in accurately identifying eighth grade students who have initiated use could be considered beneficial given the risks associated with early drug use and the importance of early drug intervention efforts.

Research Question 2

Three additional logistic regression analyses were conducted in order to answer Research Question 2 of whether or not positive prosocial environments within the family and community settings moderate the relationship between eighth grade adolescent substance use and involvement with drug-using friends. The last of these analyses was conducted to determine which (if any) of these three settings is most likely to decrease the likelihood of adolescent drug use within the past 30 days.

The first of the three secondary analyses was a combined logistic regression analysis that assessed whether the predictor variables family prosocial environment, friends' drug use, and the interaction variable friends' drug use by family prosocial environment significantly predicted whether or not a student had used drugs (tobacco, alcohol, marijuana, and/or inhalants) in the last 30 days. Results are presented in Table 7. When friends' drug use, family prosocial environment, and the interaction variable of friends' drug use by family prosocial environment were considered together in a

combined analysis, they significantly predicted whether or not a student used drugs in the past 30 days ($\chi^2 = 2202.71$, $df = 11$, $N = 10767$, $p < .001$). friends' drug use was once again found to be a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days. Within this combined model, odds ratio scores indicate that the likelihood of a student who had reported a low level of friends' drug use to have reported using drugs within the past 30 days was 5.96 times that of students who reported no friends' drug use. Students who reported medium or high levels of friends' use were 18.48 and 33.73 times as likely, respectively, to have reported using drugs within the past 30 days compared to students who reported no friends' drug use.

Overall, family prosocial environment was also found to be a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days. The odds of a student using drugs within the past 30 days who reported a medium level of family prosocial environment were .43 times the odds of those students who reported a low level of family prosocial environment. The odds of students using drugs within the past 30 days who reported high levels of family prosocial environment were .16 times the odds that were reported by students who reported a low level of family prosocial environment. Overall, these results indicate that a higher score on the family prosocial environment variable appeared to act as a protective factor by diminishing the odds of eighth grade adolescent drug use.

The overall interaction between friends' drug use and family prosocial environment approached, but did not reach statistical significance ($p = .057$). The interaction between a high level of family prosocial environment and a high level of friends' drug use was one of two interaction variables that were found to be statistically

Table 7

Combined Logistic Regression Predicting Adolescent Drug Use in the Past 30 Days: Friends' Drug Use, Family Prosocial Environment, and Interaction Variables

Variable	*B*	*SE*	Odds ratio	*p*
Friends' Drug Use Overall	-	-	-	.000*
Low	1.79	.30	5.96	.000*
Medium	2.92	.33	18.48	.000*
High	3.52	.34	33.73	.000*
Family Prosocial Overall	-	-	-	.000*
Medium	-.84	.29	.43	.000*
High	-1.82	.28	.16	.000*
Friends' Drug Use by Family Prosocial Overall	-	-	-	.057
Medium Prosocial*High Friends' Drug Use	.37	.39	1.45	.342
High Prosocial*High Friends' Drug Use	1.03	.41	2.79	.012*
Medium Prosocial*Medium Friends' Drug Use	.56	.37	1.76	.131
High Prosocial*Medium Friends' Drug Use	.69	.38	1.99	.068
Medium Prosocial*Low Friends' Drug Use	.38	.34	1.47	.258
High Prosocial*Low Friends' Drug Use	.85	.34	2.35	.011*
Constant	-2.53	.25	.08	.000

*Statistically significant

significant (p = .012). Results from this variable indicate that students who reported a high level of family prosocial environment and a high level of friends' drug use had increased odds of drug use within the past 30 days (2.79 times greater odds) when compared to students who reported a low level of family prosocial environment and no friends' drug use. The interaction between a high level of family prosocial environment and a low level of friends' drug use was the only other interaction variable in this analysis that was found to be statistically significant (p = .011). Results from this variable indicate that students who reported a high level of family prosocial environment and a low level of friends' drug use had increased odds of drug use within the past 30 days (2.35 times greater odds) when compared to students who reported a low level of family prosocial environment and no friends' drug use. Overall, the near statistically significant results indicate that family prosocial environment could possibly act as a moderator within the relationship between friends' drug use and individual adolescent drug use; however, the results are not conclusive.

Results from Block 0 of the analysis, which is a section of the analysis that did not include any of the predictor variables, indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct for 89.3% of the sample. In Block 1, when friends' drug use, family prosocial environment, and friends' drug use by family prosocial environment were all included in the analysis, the accuracy rate increased to 90.8%. The small increase in accuracy are comparable to those found within the school prosocial environment model, and again indicate that this combined model slightly increased the

overall ability to accurately predict whether or not eighth grade students had use drugs within the past 30 days.

The next analysis was a combined logistic regression analysis that assessed whether the predictor variables community prosocial environment, friends' drug use, and the interaction variable friends' drug use by community prosocial environment significantly predicted whether or not a student had used drugs (tobacco, alcohol, marijuana, and/or inhalants) in the last 30 days. Results are presented in Table 8. When friends' drug use, community prosocial environment, and the interaction variable of friends' drug use by community prosocial environment were considered together in a combined analysis, they significantly predicted whether or not a student used drugs in the past 30 days ($\chi^2 = 2185.45$, df = 11, N = 10767, $p < .001$). friends' drug use was once again found to be a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days. Within this combined model, odds ratio scores indicate that the likelihood of a student who had reported a low level of friends' drug use to have reported using drugs within the past 30 days was 6.43 times that of students who reported no friends' drug use. Students who reported medium or high levels of friends' use were 18.63 and 53.97 times as likely, respectively, to have reported using drugs within the past 30 days compared to students who reported no friends' drug use.

Overall, community prosocial environment was also found to be a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days. The odds of a student using drugs within the past 30 days who reported a medium level of community prosocial environment were .37 times the odds of those students who reported a low level of community prosocial environment. The odds of students using

Table 8

Combined Logistic Regression Predicting Adolescent Drug Use in the Past 30 Days: Friends' Drug Use, Community Prosocial Environment, and interaction variables

Variable	B	SE	Odds ratio	P
Friends' Drug Use Overall	-	-	-	.000*
Low	1.86	.24	6.43	.000*
Medium	2.92	.27	18.63	.000*
High	3.99	.28	53.97	.000*
Community Prosocial Overall	-	-	-	.000*
Medium	-1.00	.24	.37	.000*
High	-1.49	.30	.23	.000*
Friends' Drug Use by Community Prosocial Overall	-	-	-	.067
Medium Prosocial*High Friends' Drug Use	.31	.39	1.40	.388
High Prosocial*High Friends' Drug Use	.52	.56	1.68	.352
Medium Prosocial*Medium Friends' Drug Use	.83	.31	2.30	.006*
High Prosocial*Medium Friends' Drug Use	.03	.54	1.04	.949
Medium Prosocial*Low Friends' Drug Use	.68	.28	1.96	.014*
High Prosocial*Low Friends' Drug Use	.34	.39	1.40	.388
Constant	-2.93	.21	.05	.000

*Statistically significant

drugs within the past 30 days who reported high levels of community prosocial environment were .23 times the odds that were reported by students who reported a low level of community prosocial environment. Overall, these results indicate that a higherscore on the community prosocial environment variable appeared to act as a protective factor by diminishing the odds of eighth grade adolescent drug use.

The overall interaction between friends' drug use and community prosocial environment approached, but did not reach statistical significance ($p = .067$). The interaction between a medium level of community prosocial environment and a medium level of friends' drug use was one interaction variable that was found to be statistically significant ($p = .006$). Results from this analysis indicate that students who reported a medium level of community prosocial environment and a medium level of friends' drug use had increased odds of drug use within the past 30 days (2.30 times greater odds) when compared to students who reported a low level of community prosocial environment and no friends' drug use. The interaction between a medium level of community prosocial environment and a low level of friends' drug use was the only other interaction variable in this analysis that was found to be statistically significant ($p = .014$). Results from this variable indicate that students who reported a medium level of community prosocial environment and a low level of friends' drug use had increased odds of drug use within the past 30 days (1.96 times greater odds) when compared to students who reported a low level of community prosocial environment and no friends' drug use. Overall, the near statistically significant results indicate that community prosocial environment could possibly act as a moderator within the relationship between

friends' drug use and individual adolescent drug use; however, the results are not conclusive.

Results from Block 0 of the analysis, which is a section of the analysis that did not include any of the predictor variables, indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct for 89.2% of the sample. In Block 1, when friends' drug use, community prosocial environment, and friends' drug use by community prosocial environment were all included in the analysis, the accuracy rate increased to 90.5%. The small increase in accuracy is also comparable to those found within the school prosocial environment and family prosocial environment models, and again indicates that this combined model slightly increased the overall ability to accurately predict whether or not eighth grade students had used drugs within the past 30 days.

The final logistic regression analysis was a forward stepwise analysis, which was conducted to provide greater information about the individual contribution of each of the variables within the model. A forward stepwise regression analysis begins with no variables in the model, with a new variable that is found to be statistically significant being added at each successive step. All of the previous predictor variables, including the interaction variables, were included in the analysis. The three predictor variables that were found to be statistically significant in this analysis were friends' drug use, family prosocial environment, and community prosocial environment. The school prosocial environment and each of the interaction variables were not statistically significant within this analysis, which led to these variables being excluded from each of the steps. Table 9 provides the data from the forward stepwise logistic regression analysis.

Friends' drug use was the first statistically significant predictor variable that was included in step 1. Step 2 contained friends' drug use and added family prosocial environment. Step 3 contained the previous two variables as well as the community prosocial environment variable. Given the nature of this analysis, all variables within each step were statistically significant ($p < .001$), indicating that the predictor variables within each step were found to significantly predict eighth grade adolescent drug use within the past 30 days. As the levels in each variable increased (e.g., going from low friends' drug use to medium friends' drug use) the effect on eighth grade adolescent drug use also increased. These trends found within each of the variables indicate that increases in each of these variables were associated with consistent increases (friends' drug use variable) or decreases (both prosocial variables) in the likelihood of eighth grade adolescent drug use. The friends' drug use odds ratio scores from the stepwise analysis were consistently much larger in magnitude than either of the two prosocial factors, indicating that the friends' drug use variable had a much greater impact on the likelihood of adolescent drug use within the past 30 days than any of the other predictor variables.

Results from Block 0 of the stepwise analysis, which did not include any of the predictor variables, indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct for 89.3% of the sample. Table 10 provides information on the predictive accuracy for each step of the analysis. The three main table columns contain the percentage of the sample that was correctly identified to have used drugs in the past 30

Table 9

Forward Stepwise Logistic Regression Predicting Adolescent Drug Use in the Past 30 Days

Step	Variable	*B*	*SE*	Odds ratio	*p*
Step 1	Friends' Drug Use Overall	-	-	-	.000
	Low	2.54	.11	12.70	.000
	Medium	3.76	.13	43.14	.000
	High	4.49	.14	89.34	.000
	Constant	-3.94	.09	.02	.000
Step 2	Friends' Drug Use Overall	-	-	-	.000
	Low	2.37	.11	10.72	.000
	Medium	3.54	.13	34.44	.000
	High	4.18	.14	65.37	.000
	Family Prosocial Overall	-	-	-	.000
	Medium	-.45	.13	.64	.000
	High	-1.12	.13	.33	.000
	Constant	-3.09	.14	.05	.000
Step 3	Friends' Drug Use Overall	-	-	-	.000
	Low	2.31	.11	10.06	.000
	Medium	3.44	.13	31.26	.000
	High	4.07	.14	58.58	.000
	Community Prosocial Overall	-	-	-	.000
	Medium	-.30	.10	.74	.004
	High	-.78	.17	.46	.000
	Family Prosocial Overall	-	-	-	.000
	Medium	-.38	.13	.69	.003
	High	-.95	.13	.39	.000
	Constant	-2.84	.16	.06	.000

days, to not have used drugs in the past 30 days, and an overall correct identification in both categories. While the overall correct percentage did increase from step 1 to step 3 (90.5% to 90.8%), the percentage correct changed only slightly, indicating that the community and family prosocial environment predictors did not produce much gain in the overall predictive accuracy of the model. In addition, the friends' drug use variable consistently produced odds ratios that affected the likelihood of adolescent drug use substantially more than either of the other two predictor variables. These results indicate that friends' drug use appeared to contribute more to the predictive accuracy of the model than the other two variables, which is consistent with results from the previous analyses. It is also important to note that the overall predictive accuracy of step 3 was equal to step 2. While the overall accuracy was equal, step 2 produced a higher rate of

Table 10

Forward Stepwise Logistic Regression Prediction Rates

	Did Not Report Drug Use in Past 30 Days		Reported Drug Use in Past 30 Days		Total Sample
Step	Correctly Identified*	False Positive Rate[1]	Correctly Identified**	False Negative Rate[2]	Total Percentage Correctly Predicted***
Step 1	98.2%	1.8%	26.4%	73.6%	90.5%
Step 2	96.9%	3.1%	39.3%	60.7%	90.8%
Step 3	97.9%	2.1%	31.7%	68.3%	90.8%

*Percentage of students who reported no use that were correctly identified to have not reported using drugs within the past 30 days. **Percentage of students that was correctly identified to have reported using drugs within the past 30 days. ***Total percentage of sample that was correctly identified to have either used or not used drugs within the past 30 days. [1]Percentage of sample that was incorrectly identified to have reported not using drugs within the past 30 days when they had in fact reported use. [2]Percentage of sample that was incorrectly identified to have reported using drugs within the past 30 days when they had reported no use.

correctly identifying students who had used drugs (39.3% vs. 31.7%), and a lower rate of false negatives (60.7% vs. 68.3%), than step 3. Step 3 did produce a higher rate of accurately identifying those who had not used in the past 30 days (97.9% vs. 96.9%), which in turn produced a lower rate of false positives (2.1% vs. 3.1%). Given these results, it would appear that more students who had used drugs in the past 30 days would be identified using the combination of variables found within step 2 rather than the combination of variables found within step 3. Although step 2 produced a slightly higher rate of false positives, the benefits of identifying more students who had used drugs within the past 30 days would likely be a greater benefit than the increased number of inaccurately identified students who had not used within the past 30 days.

CHAPTER IV

DISCUSSION

Major Findings

The goal of this study was to investigate the relationship between adolescent drug use, use of drugs among peers, and prosocial environments. More specifically, a significant relationship between peer substance use and adolescents' own individual substance use has been analyzed in multiple studies with results clearly indicating that there is a strong positive relationship between these two factors (Cleveland et al., 2008; Ennett et al. 2006; Galea et al., 2004; Olds & Thombs, 2001; Steinberg et al., 1994; Windle, 2000). Given the strength of this relationship, this research study sought to analyze protective factors that could possibly moderate the strength of the relationship between adolescent drug use and friends' drug use. The three protective factors that were analyzed in this study were school prosocial environment, family prosocial environment, and community prosocial environment. Each of the three prosocial variables were found to reduce the likelihood of eighth grade adolescent drug use within the past 30 days, which is consistent with prior research that has found prosocial involvement to be negatively correlated with delinquent behaviors (Kaufman et al., 2007). However, it is important to note that friends' drug use consistently had a much larger effect on the

likelihood of eighth grade adolescent drug use within the past 30 days than school, family, or community prosocial environment. Interactions between each of the three prosocial variables and friends' drug use were analyzed to assess possible moderation effects. The analyses found that none of the interactions were statistically significant, indicating that the prosocial variables were not statistically significant moderators within the relationship between individual adolescent drug use and friends' drug use. Notwithstanding, the interaction between family prosocial environment and friends' drug use, and community prosocial environment and friends' drug use did approach statistical significance ($p = .057$ and .067, respectively), which could be an indication that stronger family and community prosocial environments may diminish the strength of the relationship between friends' drug use and individual adolescent drug use. A more detailed discussion of the results associated with the friends' drug use variable as well as each of the three prosocial variables follows.

Friends' Drug Use

A total of four logistic regression analyses were conducted for this research study. friends' drug use was the only predictor variable that was included in each of these analyses. Friends' drug use was found to be a statistically significant predictor of eighth grade adolescent drug use in each of the four logistic regression analyses that were conducted. In each of the three combined logistic regression analyses, friends' drug use produced odds ratio scores that were much larger than those that were produced by the other variables. In addition, these odds ratio scores were relatively consistent in their magnitude and in the trend found within each analysis. The trend found across analyses

revealed that higher levels of friends' drug use consistently produced higher odds ratio scores. These higher odds ratio scores indicate that participants who reported higher levels of drug use by their friends had a much greater likelihood (increased likelihoods ranged from approximately 6 to 54 times) to have reported use within the past 30 days than students who had reported no friends' drug use (See Tables 6, 7, and 8). These findings are consistent with many previous research studies that have regularly found peer drug use to be highly positively correlated with individual adolescent drug use (Cleveland et al., 2008; Dishion & Owen, 2002; Duncan et al., 1995; Ennett et al., 2006; Galea, Nandi, & Vlahov, 2004; Olds & Thombs, 2001; Steinberg, Fletcher, & Darling, 1994; Windle, 2000). The increased likelihood of drug use associated with friends' drug use is particularly robust in this study, which could possibly be explained in part by the items that make up the friends' drug use variable. The variable consisted of the reported number of the respondents' "four best friends" who had used drugs within four separate categories within the past year. Given that the friends identified in these questions are designated as "best friends," it is not surprising that results would be particularly large in magnitude given the level of closeness that is often found within adolescent relationships with "best friends."

One section of each of the analyses examined the accuracy of predicting whether or not participants had reported drug use. Results from the stepwise logistic regression analysis (see Table 10) indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct, by chance, for 89.3% of the sample. Friends' drug use was the only predictor variable in step 1, family prosocial environment was added to the model in step 2, and

community prosocial environment was added to the model in step 3. While the overall correct percentage did increase from step 1 to step 3 (90.5% to 90.8%), the percentage correct changed only slightly, indicating that the community and family prosocial environment predictors did not produce much gain in the overall predictive accuracy of the model. In addition, the friends' drug use variable consistently produced odds ratios that affected the likelihood of adolescent drug use substantially more than either of the other two predictor variables. These results indicate that friends' drug use appeared to contribute more to the predictive accuracy of the model than the other two variables, which is consistent with results from the previous analyses. It is also important to note that even though the overall predictive accuracy of step 3 was equal to step 2, the variable in step 2 produced a higher rate of correctly identifying students who had used drugs (39.3% vs. 31.7%), and a lower rate of false negatives (60.7% vs. 68.3%), than step 3. Given these results, it would appear that more students who had used drugs in the past 30 days would be identified using the combination of the friends' drug use and family prosocial environment variables found within step 2 rather than the combination of variables found within step 3.

School Prosocial Environment

A combined logistic regression analysis that assessed whether the predictor variables school prosocial environment and friends' drug use significantly predicted whether or not a student had used drugs in the last 30 days found that school prosocial environment was a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days (see Table 6). The odds of a student who reported a medium or

high level of school prosocial environment using drugs within the past 30 days were .46 and .25 times the odds of those students who reported a Low level of school prosocial environment, respectively. These results indicate that higher scores on school prosocial environment appeared to act as a protective factor by diminishing the odds of eighth grade adolescent drug use. The interaction between friends' drug use and school prosocial environment was also included in the analysis to determine if school prosocial environment acted as a moderator variable. The overall interaction was not found to be statistically significant ($p = .246$). The interaction between a high level of school prosocial environment and a high level of friends' drug use was the only interaction variable that was found to be statistically significant ($p = .010$). Results from this variable indicate that students who reported a high level of school prosocial environment and a high level of friends' drug use had increased odds of drug use within the past 30 days (3.30 times greater odds) when compared to students who reported a low level of school prosocial environment and no friends' drug use. Overall, the lack of statistical significance indicates that school prosocial environment did not significantly moderate the relationship between friends' drug use and individual adolescent drug use within this analysis.

Another portion of the combined analysis examined the accuracy of predicting whether or not participants had reported drug use. Results indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct, by chance, for 89.1% of the sample. When friends' drug use, school prosocial environment, and friends' drug use by school prosocial environment were used to predict reported drug use, the prediction accuracy

rate increased to 90.3%. The small increase in accuracy indicates that while the results were statistically significant, the combined model only slightly increased the overall ability to accurately predict whether or not eighth grade adolescents had used drugs within the past 30 days.

A forward stepwise logistic regression analysis was also conducted. All of the previous predictor variables, including the interaction variables, were included in the analysis. The school prosocial environment variable was not found to be statistically significant within this analysis, which led to it being excluded from each of the steps. This analysis provided further evidence that the effect of school prosocial environment on eighth grade adolescent substance use was much smaller than the effects of the other predictor variables.

Family Prosocial Environment

A combined logistic regression analysis that assessed whether the predictor variables family prosocial environment and friends' drug use significantly predicted whether or not a student had used drugs in the last 30 days found that family prosocial environment was a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days (see Table 7). The odds of a student who reported a medium or high level of family prosocial environment using drugs within the past 30 days were .43 and .16 times the odds of those students who reported a low level of family prosocial environment, respectively. These results indicate that higher scores on family prosocial environment appeared to act as a protective factor by diminishing the odds of eighth grade adolescent drug use. The interaction between friends' drug use and family

prosocial environment was also included in the analysis to determine if family prosocial environment acted as a moderator variable. The overall interaction between friends' drug use and family prosocial environment approached, but did not reach statistical significance ($p = .057$). The interaction between a high level of family prosocial environment and a high level of friends' drug use was one of two interaction variables that were found to be statistically significant ($p = .012$). Results from this variable indicate that students who reported a high level of family prosocial environment and a high level of friends' drug use had increased odds of drug use within the past 30 days (2.79 times greater odds) when compared to students who reported a low level of family prosocial environment and no friends' drug use. The interaction between a high level of family prosocial environment and a low level of friends' drug use was the only other interaction variable in this analysis that was found to be statistically significant ($p = .011$). Results from this variable indicate that students who reported a high level of family prosocial environment and a low level of friends' drug use had increased odds of drug use within the past 30 days (2.35 times greater odds) when compared to students who reported a low level of family prosocial environment and no friends' drug use. Despite differing levels of Family Prosocial Involvement (high and low) within these significant interactions, the likelihood that an adolescent had reported drug use increased when either high or low levels of friends' drug use were reported. One possible interpretation is that the effect of friends' drug use was much greater than the effect of family prosocial environment. Overall, results that approached statistical significance indicate that family prosocial environment could possibly act as a moderator within the

relationship between friends' drug use and individual adolescent drug use; however, these results are not conclusive.

Another portion of the combined analysis examined the accuracy of predicting whether or not participants had reported drug use. Results indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct, by chance, for 89.3% of the sample. When friends' drug use, family prosocial environment, and friends' drug use by family prosocial environment were used to predict reported drug use, the prediction accuracy rate increased to 90.8%. The small increase in accuracy indicates that while the result were statistically significant, the combined model only slightly increased the overall ability to accurately predict whether or not eighth grade adolescents had used drugs within the past 30 days.

As was noted earlier, a forward stepwise logistic regression analysis was also conducted. All of the previous predictor variables, including the interaction variables, were included in a three-step logistic regression analysis. None of the interaction terms were statistically significant; consequently, no interactions were including in any of the three steps. The lack of statistically significant interaction variables in this analysis provides additional support to prior evidence, which indicates that the three prosocial environment variables did not act as moderators between friends' drug use and eighth Grade Adolescent Drug use. The family prosocial environment variable was found to be statistically significant within this analysis ($p < .001$), and was included in steps 2 and 3 of the three-step analysis (see Table 9). Increases in levels of family prosocial environment were associated with decreases in the likelihood of adolescent drug use.

Results from this analysis indicate that the effect of family prosocial environment on eighth grade adolescent drug use was statistically significant, and was associated with a decreased likelihood of adolescent drug use.

Community Prosocial Environment

A combined logistic regression analysis that assessed whether the predictor variables community prosocial environment and friends' drug use significantly predicted whether or not a student had used drugs in the last 30 days found that community prosocial environment was a statistically significant predictor ($p < .001$) of adolescent drug use within the past 30 days (see Table 8). The odds of a student using drugs within the past 30 days who reported a medium or high level of community prosocial environment were .37 and .23 times the odds of those students who reported a low level of community prosocial environment, respectively. These results indicate that higher levels of community prosocial environment appeared to act as a protective factor by diminishing the odds of eighth grade adolescent drug use. The overall interaction between friends' drug use and community prosocial environment approached, but did not reach statistical significance ($p = .057$). The interaction between a medium level of community prosocial environment and a medium level of friends' drug use was one of two interaction variables that were found to be statistically significant ($p = .006$). Results from this variable indicate that students who reported a medium level of community prosocial environment and a medium level of friends' drug use had increased odds of drug use within the past 30 days (2.30 times greater odds) when compared to students who reported a low level of community prosocial environment and no friends' drug use.

The interaction between a medium level of community prosocial environment and a low level of friends' drug use was the only other interaction variable in this analysis that was found to be statistically significant ($p = .014$). Results from this variable indicate that students who reported a medium level of community prosocial environment and a low level of friends' drug use had increased odds of drug use within the past 30 days (1.96 times greater odds) when compared to students who reported a low level of community prosocial environment and no friends' drug use. Despite medium levels of community prosocial environment within both of the significant interactions, the likelihood that an adolescent had reported drug use increased when either medium or low levels of friends' drug use were reported. One possible interpretation is that the effect of friends' drug use was much greater than the effect of community prosocial environment. Overall, results that approached statistical significance indicate that community prosocial environment could possibly act as a moderator within the relationship between friends' drug use and individual adolescent drug use; however, these results are not conclusive.

Another portion of the combined analysis examined the accuracy of predicting whether or not participants had reported drug use. Results indicated that if one predicted that all of the students within the sample had not used any of the four drugs within the past 30 days, the prediction would be correct, by chance, for 89.2% of the sample. When friends' drug use, community prosocial environment, and friends' drug use by community prosocial environment were used to predict reported drug use, the prediction accuracy rate increased to 90.5%. The small increase in accuracy indicates that while the result were statistically significant, this combined model only slightly increased the

overall ability to accurately predict whether or not eighth grade adolescents had used drugs within the past 30 days.

In the aforementioned stepwise analysis the community prosocial environment variable was found to be statistically significant ($p < .001$), and was included in step 3 of the three-step analysis (see Table 9). Increases in levels of community prosocial environment were associated with decreases in the likelihood of adolescent drug use. Results from this analysis indicate that the effect of community prosocial environment on eighth grade adolescent drug use was statistically significant, and was associated with a decreased likelihood of adolescent drug use.

Limitations and Future Research

One of the challenges noted throughout this research study was the relatively difficult nature of accurately analyzing substance abuse data. Specifically, the positively skewed distribution of the data that were used in this analysis was a particular challenge. Rates of substance abuse in the western state where the current survey data were collected are much lower than national averages; in addition to this, eighth grade adolescents also have lower rates of use when compared to older adolescents. These two factors combined to produce a sample that was particularly positively skewed even after attempted data transformations (see Table 3). A review of much of the current substance abuse research literature indicated that researchers utilize a variety of methods to address skewed distributions, with varying degrees of acknowledgment of the nature of the problem and reporting of the methods used to address skewed distributions (Botvin et al., 2000; Dishion & Owen, 2002; Henry, 2010; Henry et al., 2009; Leech et al., 2008; Parsai,

Marsiglia, & Kulis, 2010). Robust standard errors and use of the Poisson model were two methods that were used to address these concerns within the multilevel analyses that were initially used in this study. Logistic regression was utilized once it was determined that multilevel analyses would not provide the information needed for this study.

Another limitation of this study is the lack of diversity found within the sample that was used for this study. While the sample is representative of the current population found within the western state where the survey was conducted, it was a relatively homogenous sample made up of overwhelmingly Caucasian students. Given the current and future increases in diverse populations within the United States, it is increasingly more important that researchers utilize samples that more accurately reflect the diversity found within the United States. Future research in this area would likely benefit from using samples that include larger proportions of minority groups across a larger geographic area, which would in turn lead to improved generalizability of results.

The cross-sectional design of this study limits the conclusions that can be drawn. While self-reported survey data have been shown to be a reliable gauge of adolescent drug use and other delinquent behaviors (Cleveland et al., 2008), causal relationships should not be inferred without a more rigorous design such as a longitudinal or experimental design. Additionally, the prosocial environment factors that were examined in the study are based solely upon the self-reported perceptions of the adolescent participants, which may not accurately reflect the actual prosocial opportunities and rewards that are found within their schools, communities, and families. Future research may benefit from longitudinal or experimental methods to improve the ability of researchers to examine causal relationships. Future use of objective measures from

multiple sources could also strengthen the prosocial constructs that were examined in this study.

Conclusion

This study investigated the relationship between individual adolescent drug use, friends' drug use, and school, family, and community prosocial environments. Survey data from the 2007 SHARP survey collected from schools in a western state were analyzed to better understand the relationship between the aforementioned variables. Multilevel modeling and HLM were initially used to examine the data due to nesting; results indicated that differences in adolescent drug use between schools did not reach the level that would warrant multilevel analyses. Single-level logistic regression analyses were then conducted with the dataset. Results indicated a significant positive relationship between friends' drug use and eighth grade adolescents' own individual substance use, which is consistent with prior substance abuse research (Cleveland et al., 2008; Ennett et al. 2006; Galea, Nandi, & Vlahov, 2004; Olds & Thombs, 2001; Steinberg, Fletcher, & Darling, 1994; Windle, 2000). Given the strength of this relationship, this research study sought to analyze protective factors that could possibly moderate the strength of the relationship between adolescent drug use and friends' drug use. Prosocial environment within school, family, and community domains did act as protective factors by reducing the likelihood of drug use; however, school prosocial environments did not appear to significantly moderate the relationship between friends' drug use and individual adolescent drug use. The interactions between family prosocial environment and friends' drug use and community prosocial environment and friends' drug use approached

statistical significance, indicating that community and family prosocial environment may act as moderators between friends' drug use and individual adolescent drug use. While both of these protective factors approached statistical significance as moderators, it is important to note that the odds ratio scores on the friends' drug use variables within each of the analyses were substantially larger in magnitude than any other variables and consistently appeared to produce results that would indicate that friends' drug use is associated with much higher risks of past 30 day drug use than the reductions that were associated with the prosocial environment variables. These results indicate that friends' drug use is a powerful risk factor that appears to be quite resistant to the ameliorative effects of the prosocial environment factors that were measured in this study. These results contradict some prior research findings which found that family factors were associated with greater effects on reducing adolescent substance use than peer factors (Ennet et al., 2008). Additional research is needed to better understand the relationships between these variables.

The rate of accurately predicting whether or not respondents reported using drugs in the past 30 days was also examined. Results indicate that friends' drug use, school prosocial environment, community prosocial environment, and family prosocial environment contributed to relatively small increases in the ability to accurately predict adolescent substance use in the past 30 days. While these increases were relatively small, improving the ability to accurately identify eighth grade adolescent substance users is likely to be of benefit. The combination of the friends' drug use and the family prosocial environment appeared to provide the greatest increase in accurately identifying students who had used drugs in the past 30 days.

Results from the present study indicate that drug use by adolescents' friends is a significant risk factor that appears to contribute to eighth grade adolescent substance use at a level that may not be easily reduced by opportunities and rewards for prosocial involvement within the school environment. The friends' drug use by family and community prosocial environment interaction variables were the two moderators that approached statistical significance. Additional research that examines the relationship between community and family prosocial environment, friends' drug use, and adolescent drug use would likely provide greater clarity. Future research on prosocial environments and other protective factors should include a more diverse sample, a variety of age groups, and multiple measures in order to provide a better understanding of these protective factors. Future research is also needed to identify and better understand additional protective factors that may moderate the relationship between friends' drug use and individual adolescent drug use.

While the findings from this research study are not conclusive, important implications for adolescent drug use prevention and intervention efforts can be drawn. Given the strength of the relationship between eighth grade adolescent drug use and friends' drug use, prevention efforts that educate parents as well as school and community stakeholders about this relationship would likely be beneficial. In addition, given that the friends' drug use variable in this study was based upon relationships with each adolescent's four "best friends", prevention and intervention efforts may benefit from expanding intervention efforts to friendship groups rather than solely addressing individual drug use. One rather simple but important implication for parents is that they should know who their children's friends are. It may also be beneficial to maintain clear

communication between parents of adolescent friendship groups to help ensure that problems are addressed or avoided within the context of the group rather than solely at an individual level. Despite the finding that friends' drug use was the variable that was clearly associated most strongly with adolescent drug use, prosocial environments within the school, family, and community domains did reduce the likelihood of adolescent drug use, and in some cases could possibly preclude the formation of peer groups that promote antisocial behaviors by engaging adolescents in prosocial activities that are incompatible with drug use. Overall, results indicate that adolescent drug use prevention and intervention should implement strategies that address environmental and relational factors within an ecological framework that expands beyond intraindividual factors, which is consistent with current professional practices.

APPENDIX

VARIABLE ITEMS

Adolescent Substance Use	
How frequently have you smoked cigarettes during the past 30 days?	Not at all; Less than one cigarette per day; One to five cigarettes per day; About one-half pack per day; About one pack per day; About one and one-half packs per day; Two packs or more per day
On how many occasions (if any) have you had beer, wine or hard liquor during the past 30 days?	0 occasions, 1-2, 3-5, 6-9, 10-19, 20-39, 40 or more
On how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil) during the past 30 days?	0 occasions, 1-2, 3-5, 6-9, 10-19, 20-39, 40+ above
On how many occasions (if any) have you sniffed glue, breathed the contents of an aerosol spray can, or inhaled other gases or sprays, in order to get high during the past 30 days?	0 occasions, 1-2, 3-5, 6-9, 10-19, 20-39, 40+ above

Friends' Drug Use	
Think of you <u>four best friends</u> (the friends you feel closest to). In the past year (12 months), how many of your best friends have:	
smoked cigarettes?	0, 1, 2, 3, 4
tried beer, wine or hard liquor (for example, vodka, whiskey or gin) regularly?	0, 1, 2, 3, 4
used marijuana?	0, 1, 2, 3, 4
used LSD, cocaine, amphetamines or another illegal drug?	0, 1, 2, 3, 4

School Prosocial Environment	
In my school, students have lots of chances to help decide things like class activities and rules.	NO!, no, yes, YES!
Teachers ask me to work on special classroom projects.	NO!, no, yes, YES!
There are lots of chances for students in my school to get involved in sports, clubs, and other school activities outside of class.	NO!, no, yes, YES!
There are lots of chances for students in my school to talk with a teacher one-on-one.	NO!, no, yes, YES!
I have lots of chances to be part of class discussions or activities.	NO!, no, yes, YES!
My teacher(s) notices when I am doing a good job and lets me know about it.	NO!, no, yes, YES!
I feel safe at my school.	NO!, no, yes, YES!
The school lets my parents know when I have done something well.	NO!, no, yes, YES!
My teacher(s) praise me when I work hard in school.	NO!, no, yes, YES!

Family Prosocial Environment	
My parents ask me what I think before most family decisions affecting me are made.	NO!, no, yes, YES!
If I had a personal problem, I could ask my mom or dad for help.	NO!, no, yes, YES!
My parents give me lots of chances to do fun things with them.	NO!, no, yes, YES!
Do you enjoy spending time with your mother?	NO!, no, yes, YES!
Do you enjoy spending time with your father?	NO!, no, yes, YES!
My parents notice when I am doing a good job, and let me know about it.	Never or almost never, Sometimes, Often, All the time
How often do your parents tell you they're proud of you for something you've done?	Never or almost never, Sometimes, Often, All the time

Community Prosocial Environment:	
There are lots of adults in my neighborhood I could talk to about something important	NO!, no, yes, YES!
Which of the following activities for people your age are available in your community?	
sports teams.	No, Yes

scouting.	No, Yes
boys and girls clubs.	No, Yes
4-H clubs.	No, Yes
service clubs.	No, Yes
My neighbors notice when I am doing a good job and let me know about it.	NO!, no, yes, YES!
There are people in my neighborhood who are proud of me when I do something well.	NO!, no, yes, YES!
There are people in my neighborhood who encourage me to do my best.	NO!, no, yes, YES!

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